

GAZARYAN, K.G.; SHUPPE, N.G.; PROKOSHKIN, B.D.

Synthesis of AU-type RNA in animal cells. Dokl. AN SSSR 164
no.6:1413-1416 O '65. (MIRA 18:10)

1. Submitted February 23, 1965.

PROKOSHIN, Dmitriy Antonovich; ZUDIN, Ivan Feofanovich; SHARIPKULOV, Rustan Salikhovich; BANNIKH, Oleg Aleksandrovich; KURNAKOV, N.N., prof., doktor khim. nauk, otv. red.; CHERNOV, A.N., red. izd-va; VOLKOVA, V.Ye., tekhn. red.

[Alloying of chromium-manganese stainless steel] Legirovanie khromomargantsovistoi nerzhavayushchei stali. Moskva, Izd-vo Akad.nauk SSSR, 1961. 74 p. (MIRA 14:11)
(Chromium-manganese steel—Metallurgy)

PROKOSHIN, D.A., doktor tekhn.nauk, prof.; CHZAN SHAO-TSZYUN [Chang Shao-chiung]

Effect of certain oxides on the recrystallization of molybdenum.
Metalloved. 1 term. obr. met. no.3:9-11 Mr '61. (MIRA 14:6)

1. Moskovskoye vyssheye tekhnicheskoye uchilishche imeni
Baumana.

(Molybdenum—Metallurgy)
(Crystallization)

S/139/61/000/005/007/014
E073/E335

AUTHORS: Prokoshin, D.A., Ivanov, L.I. and Yanushkevich, V.A.

TITLE: Investigation of the activation energy of steady-state creep of β -titanium

PERIODICAL: Izvestiya vysshikh uchebnykh zavedeniy, Fizika, no. 5, 1961, pp. 65 - 67

TEXT: The investigations were by the torsion method. The equipment and the method of investigation were described by the authors and their team in Ref. 2 (Izv. AN SSSR, OTN, no. 6, 1959). All the experiments were made in a vacuum of

10^{-5} mm Hg. 3-mm dia. titanium specimens with a gauge length of 12 mm, machined to an accuracy of ± 0.01 mm, were used. All the specimens were polished. Two types of titanium were used: a forged 12-mm dia. titanium rod of a guaranteed purity of 99.5%; iodide titanium which was additionally purified by zonal fusion to a purity of at least 99.9%. The forged titanium contained the following impurities (in %): 0.05 Fe; 0.03 Cl; 0.03 Si; 0.05 C; 0.02 N₂; 0.11 O₂. The tests were made in the

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Investigation of

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temperature range 1 000 - 1 500 °C by the method of thermal cycling, whereby each specimen was tested with a constant load at various temperatures. The loads applied in the tests were 12.96, 15.62, 19.6 and 26.35 kg/cm². This enables eliminating the influence of individual peculiarities of the specimen, which is particularly important when investigating the activation energy of creep. It was found that the activation energy of steady-state creep of β-titanium did not depend on the test temperature or on the applied stresses. For the applied stresses the creep activation energy of β-titanium was lower than the activation energy of the self-diffusion of β-titanium and corresponded to limit values of Q, which were calculated from the conditions of transition from the solid into the liquid state. There are 2 figures, 2 tables and 7 references: 5 Soviet-bloc and 2 non-Soviet-bloc. The two English-language references mentioned are: Ref. 3 - O.D. Sherby, I.L. Lytton and I.E. Dorn - Acta Metallurgica, v. 5, no. 4, 1957; Ref. 6 - J.W. Edwards, Card 2/3

Investigation of

S/139/61/000/005/007/014
E073/E335

H.L. Johnston and W.E. Dittmarsh, J. Amer. chem. Soc., 75, 2467,
1953.

ASSOCIATION: Institut metallurgii imeni A.A. Baykova
(Institute of Metallurgy imeni A.A. Baykov)

SUBMITTED: August 5, 1960

Card 3/3

ARZHANYI, P. M. (Moskva); VOLKOVA, R. M. (Moskva); PROKOSHIN, D. A.
(Moskva); Prinsipala uchastiye: PETROVA, R. V.

Thermal diffusion in the system tungsten-beryllium. Izv. AN
SSSR. Otd. tekhn. nauk. Met. 1 topl. no. 6: 162-166 N-D '62.
(MIRA 16:1)

(Tungsten) (Diffusion coatings)

PROKOSHKIN, D. A.; VASIL'YEVA, Ye. V.; RYABYSHEV, A. M.

Investigating the oxidation of niobium-titanium-zirconium
alloys. Trudy Inst. met. no.13:157-162 '63. (MIRA 16:4)

(Niobium-titanium-zirconium alloys—Metallography)
(Oxidation)

L 11081-63 EWP(q)/EWT(m)/BDS AFFTC/ASD JH/JG
 ACCESSION NR: AP3000300 S/0020/63/150/001/0096/0098

AUTHOR: Arzhanyy, P. M.; Volkova, R. M.; Prokoshkin, D. A.

TITLE: Investigation of the niobium-beryllium system

SOURCE: AN SSSR. Doklady*, v. 150, no. 1, 1963, 96-98

TOPIC TAGS: niobium-beryllium system, phase diagram, phase composition, intermetallic compound, lattice parameter, melting point, microhardness, formation heat, diffusion coating

ABSTRACT: For the preliminary experiments the alloys were prepared by diffusion coating of 98.9%-pure Nb (microhardness, 200 kg/mm²) with 99.8%-pure Be in the 900 to 1300C temperature range with exposures of varying length. Microscopic examination revealed that the diffusion coating consists of several layers of various thicknesses. The innermost layer, the thinnest, was found to have a hexagonal lattice with the parameters $a = 4.516$ and $c = 7.387$ kX and a chemical composition corresponding to the NbBe₂ phase. The next layer, thicker, has a chemical composition corresponding to NbBe, with a microhardness of 1580 kg/mm². This is a new compound not previously mentioned in literature. The next layer, still thicker, consists of NbBe₃, which has a rhombohedral structure with the

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ACCESSION NR: AP3000300

parameters $a = 7.56$ and $c = 10.73$ kX; its microhardness is about 1430 kg/mm². The outermost layer, the thickest, has a composition corresponding to NbBe₁₂ and a body-centered tetragonal lattice with the parameters $a = 7.376$ and $c = 4.280$ kX; its microhardness is 1200 kg/mm². The phase growth in the diffusion zone at a constant temperature follows a parabolic rate. The approximate calculated temperature dependence of diffusion coefficients for NbBe₁₂ and NbBe₈, respectively, is expressed by the equations $D = 7.66$ multiplied by $10^{-4} \exp(-32,000/RT)$ and $D = 5.7$ multiplied by $10^{-9} \exp(-14,740/RT)$. For further experiments a series of alloys including alloys corresponding to the compounds found in the diffusion zone were vacuum-arc melted from the components shown above. The heats of formation of the compounds were found to be 28.8 ± 9.6 Cal/mol for NbBe₁₂, 20.5 ± 3.2 Cal/mol for NbBe₈, 46.4 ± 3.8 Cal/mol for NbBe₅, and 14.6 ± 1.9 Cal/mol for NbBe₂. On the basis of the results of thermal, microscopic, and x-ray diffraction analysis the phase diagram of the Nb-Be system (See Fig. 1 of Enclosure) was plotted. Orig. art. has: 2 figures, 1 table, and 1 formula.

ASSOCIATION: Institut metallurgii im. A. A. Baykova (Institute of Metallurgy)

SUBMITTED: 09Jan63

DATE ACQ: 10Jun63

ENCL: 01

SUB CODE: MA,ML

NO REF SOV: 002

OTHER: 004

Card 2/32

PROKOSHKIN, D.A. (Moskva); VASIL'YEVA, Ye.V. (Moskva); YANUSHKEVICH, V.Ya.
(Moskva)

Investigating the oxidation of niobium-zirconium alloys. Izv. AN SSSR.
Otd. tekhn. nauk. Met. i gor. delo no.1:186-190 Ja-F '63. (MIRA 16:3)
(Niobium-zirconium alloys—Testing) (Oxidation)

PROKOSHIN, D.A.; ZAKHAROVA, M.I.

Isothermal section at 1200 of the niobium-molybdenum-chromium
constitutional diagram. Issl.po zharopr.splav. 8:70-74 '62.

(MIRA 16:6)

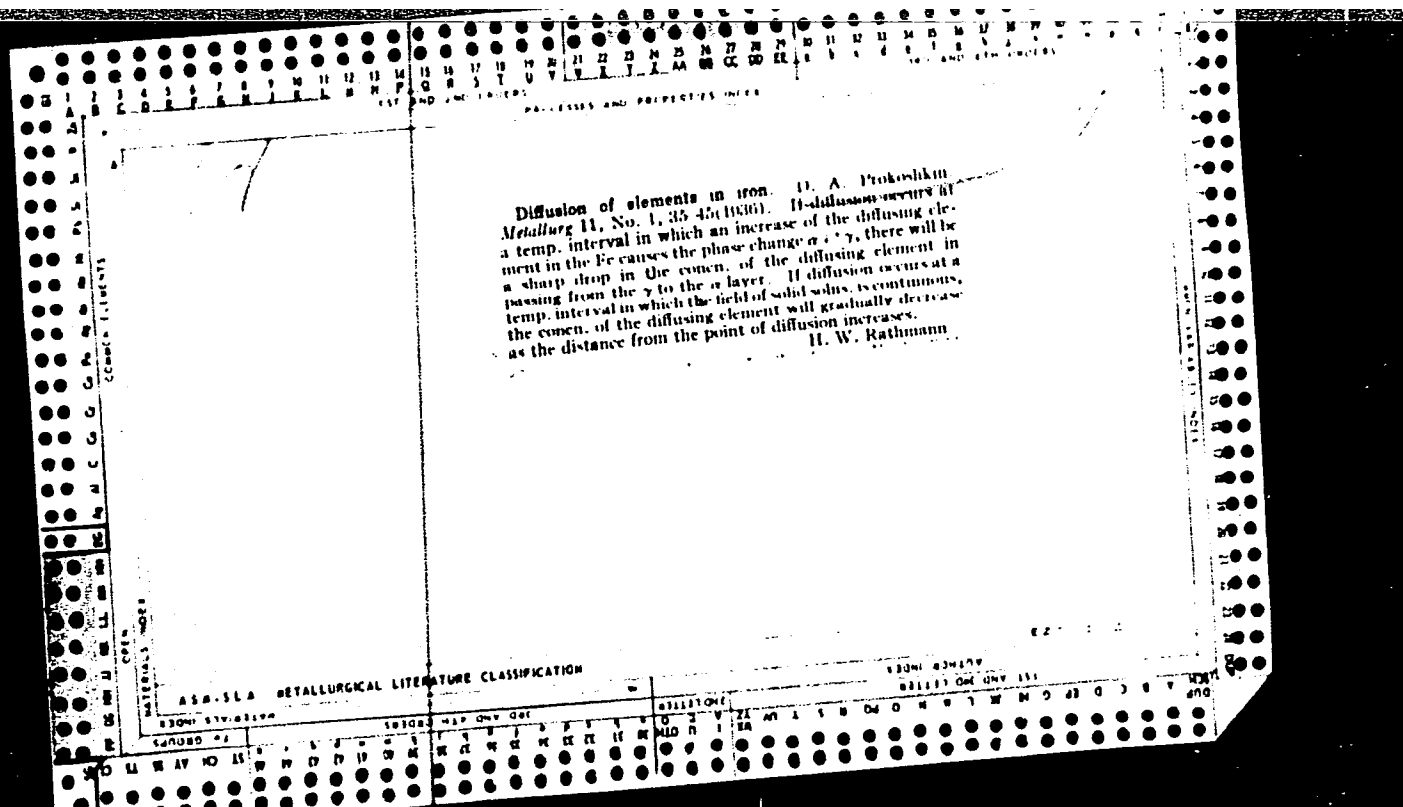
(Niobium-molybdenum-chromium alloys--Metallography)

(Phase rule and equilibrium)

PROKOSHKIN, D. A.; VASIL'YEVA, Ye. V.; Prinimali uchastiye: VERGASOVA,
L. L.; RYABYSHEV, A. M.

Investigating the oxidation of niobium-vanadium alloys. Trudy
Inst. met. no.13:152-156 '63. (MIRA 16:4)

(Niobium-vanadium alloys—Metallography)
(Oxidation)



Diffusion of molybdenum in iron. D. A. Pridemore
Metallurg 12, No. 7, 69-79 (1937), cf. C. T. 30, 8119.
Armco Fe was packed in powder. Mo and heated to 900°
Bout for 3-12 hrs. Mo diffuses into the γ -phase, trans-
forming it into α . Along the boundary of the phase
change, Mo content jumps from 1.6% in the γ phase to
1.5% in the α phase. Diffusion begins at 900° and at
1200° FeMo begins to form. H. W. Rathmann

ASNT-324 METALLURGICAL LITERATURE CLASSIFICATION

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<p>Diffusion of elements into solid iron. D. A. Prokoshkin. <i>Khim. i Termicheskie Metody Obrabotki Stali</i> (NTI) 1938, 3-134; cf. C. A. 32, 5759P. Cementation methods are reviewed and expts. on cementation by diffusion of Mo and W into solid Fe are described. The texture and the compn. of the diffusion layer beyond the limits of soly., the mechanism of diffusion and the effect of the texture of the cementing substance on diffusion are discussed. Curves and microstructures are shown. The cementation of steel with gases produced by pyrolysis of kerosene. N. A. Minkevich. <i>Ibid.</i> 135-53; cf. C. A. 32, 7381P.</p>																										<p>Advantages of gaseous over solid cementation agents are described. Costs and equipment are discussed. Kinetics of decomposition of α-solutions in the sintering process of manufacture of alloys on iron base. B. G. Livshits and A. G. Rakhstadt. <i>Ibid.</i> 154-77. The prepn. of binary alloys by the sintering method, thermal treatment for the dispersion hardening, and the isothermal decompn. of the α-soln. (supercooled at different temps., from 500 to 1000°) are discussed, and presented in the form of diagrams, isotherms and microstructures. Investigation of tempered and of "let down" steels by the magnetic method. I. L. Mirkin and B. A. Sadikov. <i>Ibid.</i> 257-83. The magnetic method of detn. of the components of ferromagnetites and transformation processes in tempered C steels during "letting down" are described. The use of thermite and of lunkerite to improve the quality of steel ingots and bars. G. N. Ofks. <i>Ibid.</i> 204-50; cf. following abstr. A description on expts. performed with thermite and lunkerite in several plants. The compn., the methods of prepn. and the cost of lunkerite powders and of thermite are described. Through <i>Khim. Referat. Zhur.</i> 1, No. 11-12, 94-5 (1938).</p>																									
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CN

Cyaniding of high-speed steel. D. A. Prokoshkin and V. S. Tsaregorodets. *Metallurg* 13, 28-30 (July-Aug., 1938); *Met. Abstracts* (in *Metals & Alloys*) 10, No. 4, 281 (1938). —Steel samples contg. 0.74% C, 4.02% Cr, 18.4% W and 1.27% V were first heated in salt baths to 800-500° in 12-15 min. and then to 1280-1300°, and kept at that temp. for 2-3 min. The samples were then held for 10 min. in a muffle furnace at 550-600° and cooled in still air to room temp. After polishing, they were subjected to cyaniding in baths of 90% NaCN, 10% KCN + 50% NaCN, 90% K₄Fe(CN)₆ + 10% KOH, at 500-700°, 500-700°, and 550-600°, resp. During the first 15 min. the hardness rises considerably, but longer periods produce a more gradual increase. The C in the steel became concd. on the surface and formed a cementing layer, but the N diffused deeper into the Fe. C. L. B.

PROKOUSHKIN, D. A.

CA

Steel and cast iron alloyed with Pb and S. D. A. Prokoshkin and A. B. Altman. Russ. 60,970, April 30, 1940. The machining of steel and cast iron is improved by introducing PbS into the molten metal.

A.S.N.-S.L.A. METALLURGICAL LITERATURE CLASSIFICATION

PROKOSHIN, D. A.

21782

PROKOSHIN, D. A. i GORELIK, S. S.

Iegirovaniye uglerodistoy stali svintsom dlya Uluchsheniya obrabatyvayemosti.
Sbornik (Mosk. in - t stali im. Stalina), 28, 1949, s. 232-45.

SO: Letopis' Zhurnal'nykh Statey, No. 29, Moskva, 1949

BTR

8

11762. Diffusion of Carbon and Nitrogen Into Steel at High Temperatures. D. A. Prokoshin and P. M. Arzhavt. Henry Brubaker, Translation 2871, 12 pages. (From *Trudy Moskovskogo Inst. Stali im. I. V. Stalina*, "Symposium XXX, Structure and Properties of Steel," Metallurgizdat, Moscow, 1951, p. 241-255, 12 pages.

Experimental study of effects of cyaniding temperature, bath composition, and cyaniding time upon distribution of C and N in diffusion layer, and of structure and properties of cyanide case. One carbon and one low-alloy steel were studied. Part played by so-called "neutral salts" in the cyaniding bath. Results of microexamination, electron-diffraction, and x-ray studies of diffusion layer. Data on hardness, tensile, and impact properties of cyanided and carburized steels. Results of bending fatigue tests on specimens with different cyanide case thicknesses.

GTRSPL No. 45

1
Prokoshkin, D.A., The work of D.K. Chernov in metallography and thermal treatment, 931-9

Akademiya Nauk S.S.S.R., Doklady Vol. 79 No. 6, 1951

L 5456-66 EWT(1)/EPA(s)-2/EWT(m)/EPA(w)/EPA(l)-2/EPA(h)/EPA(m)-2/EPA(c) IJP(c) JD/JG/GS
ACC NR: AT5024870 SOURCE CODE: UR/0000/65/000/000/0038/0044

AUTHOR: Prokoshkin, D. A. Arzamasov, B. N.; Ryabchenko, Ye. V. 44.55 93 91 B+1

ORG: Institute of Problems of Material Science, AN UkrSSR (Institut problem materialovedeniya AN UkrSSR) 44.55 21.44.34

TITLE: Siliconizing refractory metals in a glow discharge 44.55

SOURCE: AN UkrSSR. Institut problem materialovedeniya. Diffuzionnyye pokrytiya na metallakh (Diffusion coatings on metals). Kiev, Naukova, dumka, 1965, 38-44

TOPIC TAGS: refractory metal, metal siliconizing, glow discharge siliconizing, molybdenum siliconizing, tungsten siliconizing, niobium siliconizing, tantalum siliconizing

ABSTRACT: Molybdenum, tungsten, niobium, and tantalum have been siliconized at 1000 to 1200C by glow discharge in a mixture of silicon tetrachloride vapor and hydrogen flowing at a pressure of 40 mm Hg and a rate of 0.5 l/min. The glow discharge starts at 500-700 v. The rate of siliconizing in a glow discharge depended on the pressure in the reaction chamber, the volume ratio and the rate of consumption of the silicon tetrachloride and hydrogen, and the reaction temperature and was significantly higher than that of conventional siliconizing in a gaseous medium. Molybdenum had a siliconized layer 25 μ thick in 5 min, and a layer 67 μ thick in 40 min. Higher rates were also observed in tungsten, niobium, and tantalum. The siliconized coatings consisted basically of disilicides of the respective metals. Tungsten siliconized at

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1000C for 30 min had a one-layer coating consisting of WSi_2 with a hardness of 1865 dan/mm². Niobium and tantalum had two-layer coatings, the outer layers consisting of $NbSi_2$ and $TaSi_2$, respectively, and the inner layer having a lower silicon content. The inner layer of niobium had a hardness of 1125 dan/mm². Molybdenum siliconized at 1000C for 40 min had a three-layer coating; the hardness of the outer and innermost layers was 1565 and 1350 dan/mm², respectively. Molybdenum and tungsten disilicides had a tetragonal crystal lattice; niobium and tantalum had a hexagonal lattice. Siliconizing in a glow discharge can be done below the recrystallization temperature, which keeps the parts in the strengthened condition. The high efficiency of the process can be explained by the presence of an ionized medium and by the activated condition of the metal surface being siliconized. Orig. art. has: 4 figures. [MS]

SUB CODE: MM,EM/ SUBM DATE: 06Aug65/ ORIG REF: 004/ OTH REF: 004/ ATD PRESS: 4/33

Card 2/2

SUPOV, A.V.; PROKOSHIN, D.A.; FAKHSHTADT, A.G.; MEDVEDEV, V.A.

Effect of cold hardening on mechanical properties and fine
structure of heat treated steel. Stal' 25 no.8:846-848 S
(MIRA 18:9)
'65.

1. Gosudarstvennyy nauchno-issledovatel'skiy institut po
promyshlennoy i sanitarnoy ochistke gazov.

PROKOSHIN, D.A.

D.K. Chernov's work in the field of metallography and heat treatment. (MLR 6:6)
Trudy po ist. tekhn. no. 2:64-77 '53.
(Chernov, Dmitrii Konstantinovich, 1839-1921) (Metallography)
(Steel--Heat treatment)

PROKOSHIN, D.A.

ANOSOV, Pavel Petrovich, 1797-1851; VOLODINA, N.I., redaktor; BARDIN, I.P., akademik, redaktor; GUDISOV, N.T., akademik, redaktor; SAMARIN, A.M., redaktor; STARK, B.V., redaktor; PROKOSHIN, D.A., doktor tekhnicheskikh nauk, redaktor; VISHNYAKOV, D.Ya., doktor tekhnicheskikh nauk, redaktor; DAVIDENKOV, V.A., doktor tekhnicheskikh nauk, redaktor; RASTOGAYEV, M.V., kandidat tekhnicheskikh nauk, redaktor; SCROKIN, Yu.N., kandidat tekhnicheskikh nauk, redaktor; MURZIN, I.I., inzhener, redaktor; ASTAF'YEVA, G.A., tekhnicheskii redaktor

[Collected works] Sobranie sochinenii. Moskva, Izd-vo Akademii nauk SSSR, 1954. 204 p. (MLRA 7:10)

1. Chlen-korrespondent AN SSSR (for Samarin, Stark)
(Metallurgy)

PROKOSHIN, D.A.

P.P. Anosov's work on special steel varieties. Trudy po 1st. tekhn. no. 5:
16-29 '54. (MIRA 8:1)

(Anosov, P.P.) (Steel alloys)

PROKOSHKIN, D.A., professor, doktor; SOROKIN, Yu.N., kandidat tekhnicheskikh
~~tekhnicheskikh~~

History of steel smelting in Russia. Sbor.Inst.stali no.32:5-19
'54. (MLRA 10:5)

1.Kafedra metallovedeniya i termicheskoy obrabotki.
(Steel--Metallurgy)
(Lavrov, Aleksandr Stepanovich, 1838-1904)

PROKOSHIN, D. A. doktor tekhnicheskikh nauk, professor.

Heat treatment of metals, step-by-step hardening of steel. (MLRA 9:9)

[Trudy] MVTU no.70:3-12 '56.

(Steel--Hardening)

PROKOSHIN, D.A., doktor tekhnicheskikh nauk, professor.

Structure of hardened steel. [Trudy] MVTU no.70:13-21 '56.
(MLRA 9:9)

(Steel--Metallography)

67830
SOV/180-59-6-6/31

18.8200

AUTHORS: Bystrov, L.N., Ivanov, L.I., and Prokoshkin, D.A.
(Moscow)

TITLE: Investigation of High Temperature Creep of Iron by the Torsion Method

PERIODICAL: Izvestiya Akademii nauk SSSR, Otdeleniye tekhnicheskikh nauk, Metallurgiya i toplivo, 1959, Nr. 6, pp 37-42 (USSR)

ABSTRACT: It is a well known fact that the rate of creep is temperature-dependent and that this relationship can be described by a general formula

$$u = k \exp -Q/RT \quad (1)$$

where: u is rate of creep; k is structure-sensitive, pre-exponential factor whose magnitude is greatly affected by the structure of the alloy; T is absolute temperature; Q is a parameter characterizing the energy of the process, the magnitude of which has been postulated to depend on the temperature and on the magnitude and character of the applied stress. Since various conclusions on the character of the temperature and stress dependence of Q had been reached by various workers who had studied creep of specimens in tension, the present investigation was undertaken with the object

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Investigation of High Temperature Creep of Iron by the Torsion Method

of determining the relationship between σ , temperature and stress, by studying creep of iron subjected to pure shear stress. The experiments were carried out in a specially designed vacuum apparatus, shown diagrammatically in Fig 1. The test piece (1), in the form of a cylinder of 2 - 3 mm diameter, 14 mm gauge length, with square cross section ends, was held by two molybdenum grips (2 and 3); the grip (2) was free to rotate and carried a lever (4) with a weight (5) which generated the moment M ; the weight of the lever was compensated by a counterweight (6); the grip (2) rotated on ball bearings (7) supported by a water-cooled housing and coated with silver or MoS_2 ; the grip on the right-hand side was connected to an electric motor through a worm reducing gear. Departure of lever (4) from its original, horizontal position, resulted in breaking the contact (9), connected with a low inertia, electronic relay which switched on the electric motor, rotating at a rate ω in the direction opposite to that in which the creep specimen rotated (at a rate ω_1) under the action of the applied torque. Depending upon

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SOV/180-59-6-6/31

Investigation of High Temperature Creep of Iron by the Torsion Method

the relative values of u and u_1 , the engine was switched off and on by means of contacts (9) and (10), so that the specimen was deformed under the condition of constant torque; contact (11) served to switch off the complete apparatus after rupture of the specimen. A typical creep curve of γ -iron, tested at 1100-1180 °C, under $M = 0.88$ kg cm, is reproduced in Fig 2, where the deformation, indicated on the ordinate axis in multiples of 360°, is plotted against time (min), I representing the primary creep stage, II and III the secondary stage at 1100 and 1180 °C respectively, and IV the third stage of creep. The test pieces were prepared from two types of electrolytic iron (for chemical analysis see Table 1), re-melted in vacuum and forged; each test piece was annealed at 1260 °C for 30 min. To eliminate the effect of the possible difference between the properties of test pieces of the same nominal composition on the experimental results, the creep rates at various temperatures were determined on one and the same test piece; the accuracy of the obtained data was confirmed

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Investigation of High Temperature Creep of Iron by the Torsion

Method

by good agreement between the results obtained on heating and cooling. The results of the first series of experiments are reproduced in Fig 3, where the rate of the secondary creep ($\dot{\epsilon}$, o/sec) of iron (type 1) is plotted against temperature (°C). It will be seen that in the α -Fe range, $\dot{\epsilon}$ increased exponentially with rising temperature, reaching a maximum at approximately 910 °C; at higher temperatures $\dot{\epsilon}$ gradually decreased, reaching a minimum at approximately 1050 °C. The general character of this relationship remained the same when larger torques were applied, although in these cases the minimum value of $\dot{\epsilon}$ was reached at different temperatures. The absence of a sharp drop in the rate of creep at the temperature of the $\alpha \rightarrow \gamma$ transformation was attributed to strain-hardening, associated with the volume changes accompanying the change of the crystal lattice from body-centred to face-centred. The temperature dependence of the rate of creep of γ -Fe at temperatures above 1040 °C (which has been found to follow the law described by Eq (1), is illustrated

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Investigation of High Temperature Creep of Iron by the Torsion Method

graphically in Fig 4 in the form of $\log u$ versus $1/T \times 10^4$ curves, plotted for specimens listed in Table 2 under the following headings: number of the specimen; torque (M, kg-cm); type of iron; activation energy for creep (Q, kcal/g-atom); diameter of the specimen (d, mm); τ_s - maximum tangential stress, calculated from Eq (2) (kg/cm²). Metallographic examination of specimens that had been subjected to deformation at 1100 °C showed the presence of cracks and pores (Fig 5); the density of these defects was particularly high in the surface layer of the specimen near the fracture region (Fig 5f). The formation of these defects was attributed by the authors to the generation and movement of excess vacancies; owing to the complex distribution of stress in the cross-section of the specimen strained in torsion, the density of the excess vacancies was not uniform, increasing with increasing distance from the axis of the specimen. Since it can be postulated that creep is determined by the processes of self-diffusion and formation of excess

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Investigation of High Temperature Creep of Iron by the Torsion Method

vacancies, the activation energy for creep should be equal to the sum of activation energies for these two processes, and such in fact was found to be the case. Thus, the results obtained by the authors show that the activation energy, Q , for creep of γ -Fe (within the investigated temperature and applied stress range) does not depend on the temperature and is equal 95.2 kcal/g-atom. The absolute value of Q is the same as that of the heat of evaporation of iron; in its physical sense, however, Q is most probably determined by the processes of self-diffusion and formation of excess vacancies, this view being supported by the presence of cracks and pores, formed in the course of deformation. Since it has been shown (Ref 17) that in the case of many metals, the activation energy of fracture under low applied stresses is also equal to the sum of the activation energies for self-diffusion and formation of excess vacancies, the present authors concluded that the phenomena taking place in a specimen stressed in torsion are similar to those that occur during rupture due to small tensile stresses.

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SOV/180-59-6-6/31

Investigation of High Temperature Creep of Iron by the Torsion
Method

There are 5 figures, 2 tables and 17 references, of
which 10 are Soviet and 7 English. ✓

SUBMITTED: May 29, 1959

Card 7/7

CIA-RDP86-00513R001343220013-2"

PROKOSH KIN, D.A.

3/26/76/000/004/001/001
A006/A001

AUTHORS

Shenolikov, R. S., Baryukh, O. A., Gornichev, V. V., Prokoshin, D. A., Lincsevskiy, B. V. → had Nucleases in Phase Transformation of

FILED:

Investiya Akademii Nauk
No. 4, pp. 62-69

In general, investigations have shown that the dependence of the hardness on the rate of straining is not as marked by annealed polycrystalline metals as previously [Ref. 3]. A. T. Olschok has presented evidence in steel, in copper, in D. V. Kaulin alloys [Ref. 3], B. O. Olsson on phase transformations and annealing of the foreign side of annealing and drawing with different temperatures in hardness. The effect of strain rate on the hardness of various metals has been studied by the following authors: Kurnakov, 16; Kurnakov, 17; Kurnakov, 18; Kurnakov, 19; Kurnakov, 20; Kurnakov, 21; Kurnakov, 22; Kurnakov, 23; Kurnakov, 24; Kurnakov, 25; Kurnakov, 26; Kurnakov, 27; Kurnakov, 28; Kurnakov, 29; Kurnakov, 30; Kurnakov, 31; Kurnakov, 32; Kurnakov, 33; Kurnakov, 34; Kurnakov, 35; Kurnakov, 36; Kurnakov, 37; Kurnakov, 38; Kurnakov, 39; Kurnakov, 40; Kurnakov, 41; Kurnakov, 42; Kurnakov, 43; Kurnakov, 44; Kurnakov, 45; Kurnakov, 46; Kurnakov, 47; Kurnakov, 48; Kurnakov, 49; Kurnakov, 50; Kurnakov, 51; Kurnakov, 52; Kurnakov, 53; Kurnakov, 54; Kurnakov, 55; Kurnakov, 56; Kurnakov, 57; Kurnakov, 58; Kurnakov, 59; Kurnakov, 60; Kurnakov, 61; Kurnakov, 62; Kurnakov, 63; Kurnakov, 64; Kurnakov, 65; Kurnakov, 66; Kurnakov, 67; Kurnakov, 68; Kurnakov, 69; Kurnakov, 70; Kurnakov, 71; Kurnakov, 72; Kurnakov, 73; Kurnakov, 74; Kurnakov, 75; Kurnakov, 76; Kurnakov, 77; Kurnakov, 78; Kurnakov, 79; Kurnakov, 80; 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[illegible]

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[illegible]

and 11 references, 6 Soviet, 2 American
ASSOCIATIONS: Institute of Metallurgy AS USSR
Institute of Metallurgy AN USSR (Mining Department of AS USSR)
OTHER: AS USSR (Mining Department of AS USSR)

SUBMITTED: December 23, 1959

18-8280
10-9200

1146, 1454, 1467

86065
S/180/60/000/005/006/033
E073/E535

AUTHORS:

Ivanov, L. I., Matveyeva, M.P. and Prokoshkin, D.A. (Moscow)

TITLE:

Investigation of Plastic Deformation of High Melting Alloys at Elevated Temperatures

PERIODICAL:

Izvestiya Akademii nauk SSSR, Otdeleniye tekhnicheskoy nauk, Metallurgiya i toplivo, 1960, No.5, pp.79-85

TEXT:

The results are described of investigations of creep in torsion at various stresses and temperatures in titanium, niobium and chromium. The technique of investigation was similar to that applied in earlier work (Ref.7). All the tests were carried out in vacuum with a residual pressure of 10^{-5} mm Hg, both for constant temperature and also for cyclically varying temperatures. In the latter case the specimen was tested with a constant torque at various temperatures. Straight line dependence on the diagram strain versus time was taken as evidence that the steady state of creep had been reached at the given temperature. The reliability of the obtained results was verified by the coincidence of the activation energy of the steady state creep during gradual increase and decrease in the temperature. In the case of titanium, metal of 99.5% purity was chosen that had been forged into rods of

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Investigation of Plastic Deformation of High Melting Alloys at Elevated Temperatures

12 mm diameter and also iodide titanium that had been purified by zonal melting. The specimens had a gauge length of 12 mm and a diameter of 3 mm. Their surface was carefully polished. The creep was tested in the range of β modification (1000 to 1500°C) with torques of 90.5, 109, 137 and 200 g/cm. Fig.1 shows the graphs of the logarithm of creep speed as a function of the reciprocal of the temperature for various torques. It was found that the results complied with the following relation

$$U = K \exp \left(- \frac{Q(\sigma)}{RT} \right) \quad (1)$$

where U - creep speed, Q - energy creep parameter depending on the applied stress and temperature, K - a constant which is sensitive to the structure of the metal (or the alloy). The activation energies did not vary greatly, the average being 32.3 kcal/g.atom. The creep of chromium was determined (on specimens with 14 mm gauge length and 3 mm diameter) in the temperature range 900 to 1380°C, using electrolytic chromium after resmelting in the suspended state

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S/180/60/000/005/006/033
EO73/E535

Investigation of Plastic Deformation of High Melting Alloys at
Elevated Temperatures

in an atmosphere of dried and purified helium. The dependence of the logarithm of the speed of creep of Cr on the reciprocal of the temperature for various stresses is graphed in Fig.3. Similar results for niobium specimens are plotted in Fig.5. The dependence of the activation energy of chromium and niobium on the applied stresses is plotted in Figs. 4 and 6. The following conclusions are arrived at: no temperature dependence of the activation energy of steady state creep was observed for chromium, niobium and titanium. With increasing applied stress, the creep activation energy of Cr and Nb decreases, whilst that of Ti remains unchanged. The absolute value of the creep activation energy of titanium is less than that of self-diffusion. The creep activation energy of Cr and Nb at $\tau = 0$ is a complex value equalling in the first approximation the sum of the activation energy of self-diffusion and the energy of formation of vacancies. Microscopic analysis using special methods of etching has shown clearly the validity of the dislocation mechanism of plastic deformation of chromium at

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Investigation of Plastic Deformation of High Melting Alloys at
Elevated Temperatures

elevated temperatures up to 400°C. The process of polygonization
has been investigated and it is shown that development of polygon-
ization can be observed even at the beginning of the second stage
of creep. There are 6 figures and 17 references: 9 Soviet,
1 German and 7 English. ✓

SUBMITTED: May 27, 1960

Card 4/4

18.7500

S/145/60/000/005/008/010
D221/D301 32026

AUTHORS: D.A. Prokoshkin, Doctor of Technical Sciences, Professor, and O.I. Sidunova, Candidate of Technical Sciences

TITLE: New data on thermal diffusion in the chromium-molybdenum system

PERIODICAL: Izvestiya vysshikh uchebnykh zavedeniy. Mashinostroyeniye, no. 5, 1960, 101 - 105

TEXT: The author describes the saturation of Mo with a series of elements, by thermal diffusion. Both sintered and cast Mo were used for the experiments. Spectral analysis showed no traces of Nb, Mn, Cr, Ti, V, Al and Fe in the sintered Mo. Its chemical examination revealed 0.02 % of Si, and 0.005 % of S. Technically pure metals were employed for the impregnation. Saturation with Cr was made in a vacuum oven. The phase diagram of the Cr-Mo system shows a continuous series of solid solutions at all temperatures. Investigation of the chromium layer obtained by diffusion above 1000°C indicated a region with special

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New data on thermal ...

32026
S/145/60/000/005/008/010
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cial structure and properties. The etching of sections exhibited a bright layer at the surface of the chromium-coated molybdenum, separated from the core containing polyhedron grains. The bright layer was divided into two zones. The external zone was thicker and contained grains directed parallel to the diffusion flow. The second zone, clearly separated from the first, showed no grain-boundaries. The results of tests for microhardness show a gradual increase of hardness with the depth and a sharp rise at the limit of etching. The authors explain it by the change in the structure of the diffused layer. The data reveals that in the Cr-Mo system there are special structural states instead of a continuous series of solid solutions. The authors state that this is confirmed by X-ray analysis and other investigations. There are 4 figures and 6 references. 1 Soviet-bloc and 5 non-Soviet-bloc. The 4 most recent references to the English-language publications read as follows: High Temperature Technology, Ed. in chief I.E. Campbell, 1956; R.R. Freeman and I.Z. Briggs, Jet Propulsion, v. 27, no. 2, 1957; L. Northeot, Molybdenum, 1956; M. Hansen, Constitution of binary alloys, 1958.

Card 2/3

New data on thermal ...

32026
S/145/60/000/005/008/010
D221/D301

ASSOCIATION: MVTU im. Bamana (MVTU im. Bauman)

SUBMITTED: May 18, 1959

Card 3/3

X

86076

S/180/60/000/005/017/033
E111/E135

18.1100 1045

AUTHORS:

Bannykh, O.A., Zudin, I.F., Kashin, V.I., and
Prokoshkin, D.A. (Moscow)

TITLE:

Some Properties of Iron-Aluminium Alloys Based on the
 α -Solid Solution

PERIODICAL: Izvestiya Akademii nauk SSSR, Otdeleniye tekhnicheskikh
nauk, Metallurgiya i toplivo, 1960, No.5, pp.149-155

TEXT:

The authors point to the advantageous properties (e.g.
low density, high corrosion- and scaling-resistance) of iron-
aluminium alloys, in spite of which comparatively little
industrial use is made of them. For their own investigation of
the strength and plasticity of such alloys the authors used the
following range of compositions, %: 4.87-16.82 Al; 0.005-0.094
Mn; 0.013-0.100 Si; 0.02-0.05 S; 0.002-0.012 P; 0.018-0.020 C;
0.002-0.015 O; 0.004-0.011 N; (not all the S and P analyses
were carried out). The alloys were melted in a vacuum induction
furnace described by Kashin et al. (Ref.9) or in air from
aluminium-deoxidized Armco iron and grade AB0000 (AV0000) aluminium.
Fig.1 shows alloy density as a function of aluminium content.
Impact strength as function of the test temperature is shown in
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E111/E135

Some Properties of Iron-Aluminium Alloys Based on the α -Solid Solution

Fig.2 and the cold brittleness threshold (temperature at which the alloy acquired an impact strength of 2 kg/cm²) as a function of aluminium content in Fig.3 (air-melted alloys represented by interrupted lines in both figures). For tensile testing at 20-700 °C a type 111-4P machine was used. Tensile strength, yield point and relative elongations, as functions of aluminium content for various temperatures, are shown in Fig.4. Fig.5 shows relative elongation as a function of temperature for air- and vacuum-melted alloys (right- and left-hand graphs). Grain size as a function of holding time at 1100 °C for vacuum-melted alloys is shown in Fig.6. The influence of heating temperature on hardness for two alloys with 15% Al is shown in Fig.7 (air-melted, curve 1; vacuum-melted, curve 2): the hardness of both has a maximum at about 350-450 °C, but rises much more steeply and attains a higher value with vacuum melting. Vacuum melting also improves other high-temperature properties of Fe-Al alloys.

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S/180/60/000/005/017/033
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Some Properties of Iron-Aluminium Alloys Based on the α -Solid Solution

Increasing aluminium content to about 15% increases strength at 20-600 °C; at 700 °C it has little effect. Maximum strength and adequate plasticity are obtained at 400 °C; above 600 °C strength falls sharply while plasticity increases. There are 7 figures, 1 table and 16 references: 5 Soviet, 10 English and 1 German. ✓

SUBMITTED: May 27, 1960

Card 3/3

18.7500 1413 86077
S/180/60/000/005/018/033
E021/E106

AUTHORS: Arzhanyy, P.M., Volkova, R.M., and Prokoshkin, D.A.
(Moscow)

TITLE: The Diffusion of Silver and Titanium in Niobium and the
Kinetics of Oxidation of the Alloys

PERIODICAL: Izvestiya Akademii nauk SSSR, Otdeleniye tekhnicheskikh
nauk, Metallurgiya i toplivo, 1960, No.5, pp.156-160
(+ 1 plate)

TEXT: The starting point was niobium of the following
composition: Nb 98.9, Ta 0.40, Pb 0.15, Fe 0.13, N 0.08, O 0.09,
Si 0.01, C 0.14, B 5.10⁻⁵%. Its hardness was 200 kg/mm².
Samples were subjected to saturation by silicon and titanium in the
solid state. Analysis of the diffusion layers was carried out by
metallographic, X-ray crystallographic and X-ray spectrographic
methods and by microhardness measurements. In the process of
saturating niobium with silicon and titanium one layer with a
microhardness of 1200 kg/mm² was formed at 900-1100 °C and two
layers at 1200-1300 °C. On the surface of saturated samples there

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E021/E106

The Diffusion of Silver and Titanium in Niobium and the Kinetics of Oxidation of the Alloys

was only one phase, which was shown to be niobium disilicide with titanium dissolved in it of a hexagonal structure with the parameters $a = 4.779\text{kX}$ and $c = 6.493\text{kX}$ (Fig.1). The second layer was too small to take X-ray pictures, but X-ray spectrographic analysis showed that it contained 82% niobium. It was proposed that the second phase was a solid solution of Ti_5Si_3 and Nb_5Si_3 . ✓

It was shown that the rate of diffusion of silicon and titanium together was greater than the rates of diffusion of the elements taken singly. Oxidation of the samples saturated by silicon and titanium was carried out and followed by the continuous weighing method with an accuracy of $\pm 0.0005\text{ g}$. Fig.2 shows oxidation-time curves for 1000 °C (curve 1), 1100 °C (2), 1150 °C (3) and 1200 °C (4). At 1100 °C intensive oxidation occurs after 75-80 hours and at 1200 °C after 18-20 hours. It was shown that the rate of oxidation obeyed a logarithmic law. The energy of activation of oxidation of the sample saturated with silicon and titanium was

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EO21/E106

The Diffusion of Silver and Titanium in Niobium and the Kinetics
of Oxidation of the Alloys

found to be 3660 cal./mol. The oxidation layer consisted of
rutile and tridymite. The rate of oxidation was 1.5 times slower
than the rate when silicon alone was present. The obtained film
was thin, strong, and adhered well to the niobium surface.
N.A. Il'yasheva and R.V. Petrov participated in the work. X

There are 5 figures, 4 tables and 8 Soviet references.

SUBMITTED: May 27, 1960

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S/180/60/000/005/021/033

E111/E135

AUTHORS: Dekhtyar, I.Ya., Ivanov, L.I., Matveyeva, M.P. and Prokoshkin, D.A. (Moscow)

TITLE: Influence of Plastic Deformation on the Kinetics of Evaporation of Iron from Type 10 Steel ✓

PERIODICAL: Izvestiya Akademii nauk SSSR, Otdeleniye tekhnicheskikh nauk, Metallurgiya i toplivo, 1960, No.5, pp.171-173 ✓

TEXT: The authors point out that crystal lattice defects produced by plastic deformation must affect both partial and integral thermodynamic properties. Dekhtyar et al. (Ref.1) and other authors (Refs 2, 3) have previously shown that plastic deformation affects many properties. The present work gives preliminary results of an investigation of the influence of plastic deformation (torsion) on the rate of evaporation of iron from type 10 steel (0.10% C; 0.45 Si; 0.03 P; 0.02 S; 0.26 Al; remainder Fe). The apparatus developed and used is shown in Fig.1: the hollow cylindrical specimen has its open end closed with a tantalum diaphragm to form a Knudsen cell. The specimen, subjected to torsion if required, is heated in a

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E111/E135

Influence of Plastic Deformation on the Kinetics of Evaporation
of Iron from Type 10 Steel

graphite inductor of an axially varying wall thickness. After fabrication specimens were annealed in helium for 30 minutes at 1200 °C, sealed in quartz capsules and irradiated with thermal neutrons, giving Fe^{59} . The rate of evaporation was found from the activity of the deposit on a molybdenum foil (polished to a mirror finish) in an aluminium holder cooled with liquid nitrogen. Fig.2 shows evaporation rates of iron for undeformed specimens of the steel (curve 1) and pure iron (curve 2). Fig.3 shows evaporation rate for the steel (curve 1) and the corresponding deformation rate (curve 2). The effect is complex and the authors suggest a similar study on pure iron. There are 3 figures, 1 table and 4 references: 2 Soviet and 2 English. ✓

SUBMITTED: March 22, 1960

Card 2/2

ARZHANYI, P.M.; VOLKOVA, R.M.; PROKOSHIN, D.A.

Investigating the structure and phase constitution of silicon diffusion coating of niobium. Issl. po zharopr. splav. 6:201-205 '60.

(MIRA 13:9)

(Diffusion coatings)

(Niobium silicide)

(Phase rule and equilibrium)

SOV/5947
PHASE I BOOK EXPLOITATION

Prokoshkin, Dmitriy Antonovich, Ivan Feofanovich Zudin, Rustan Salikhovich Sharipkulov, and Oleg Aleksandrovich Bannykh

Legirovaniye khromomargantsovistoy nerzhaveyushchey stali (Alloying Chromium-Manganese Stainless Steel) Moscow, Izd-vo AN SSSR, 1961. 74 p. Errata slip inserted. 3000 copies printed.

Sponsoring Agency: Akademiya nauk SSSR. Institut metallurgii im. A.A. Baykova.

Resp. Ed.: N.N. Kurnakov, Professor, Doctor of Chemical Sciences; Ed. of Publishing House: A.N. Chernov; Tech. Ed.: V.Ye. Volkova.

PURPOSE: This book is intended for metallurgists and mechanical engineers.

COVERAGE: Problems connected with the effect of different alloying elements on the phase composition, transformation, and mechanical

Card

Alloying Chromium-Manganese (Cont.)

SOV/5947

and corrosion properties of chromium-manganese stainless steels are discussed, with particular attention given to the alloying of steel containing 17 to 18% Cr and 12 to 15% Mn. The present work is based on results of investigations carried out at the Institute of Metallurgy, Academy of Sciences USSR, and on experimental data published in Soviet and non-Soviet literature. No personalities are mentioned. There are 53 references: 18 Soviet, 18 English, 16 German, and 1 Czech.

TABLE OF CONTENTS:

Foreword

I. Chromium-Manganese Stainless Steels	3
The Fe--Cr--Mn System	5
Effect of chromium and manganese on the structure and properties of steel	5
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SHARIPKULOV, R.S.; PROKOSHIN, D.A.

Mechanical and some physicochemical properties of chrome-manganese steel. Izv. AN Uz.SSR. Ser.tekh.nauk no.2:85-91 '61. (MIRA 14:3)

1. Institut metallurgii AN SSSR i Gornyy otdel AN UzSSR.
(Chrome-manganese steel--Testing)

20269

S/180/61/000/002/009/012
E071/E435

18.7500
AUTHORS:

1418, 1413, 1445

Arzhanyy, P.M., Volkova, R.M. and Prokoshkin, D.A.
(Moscow)

TITLE: On the Diffusion of Beryllium and Aluminium in Niobium

PERIODICAL: Izvestiya Akademii nauk SSSR, Otdeneliye tekhnicheskikh
nauk, Metallurgiya i toplivo, 1961, No.2, pp.119-121

TEXT: In earlier work the authors investigated the diffusion of silicon, titanium and other elements into niobium. In the present paper the results of an investigation of the diffusion of beryllium and aluminium from a solid phase into niobium at 900 to 130°C during a period of 6 hours are described. Niobium of the following composition (in %) was taken for the investigation: Nb 98.8, Ta 0.4, Pb 0.15, Fe 0.13, N 0.8, O 0.09, Si 0.01, C 0.14, B 5×10^{-5} . The distribution of the concentration in the diffusion layer was carried out by the X-ray spectroscopic method in the Institute of Metallurgy AS USSR. The microhardness was measured with an apparatus PMT-3 (PMT-3) at a load of 50 g. The X-ray photographs were taken layer by layer in an РКД (RKD) camera 57.4 mm in diameter using unfiltered chromium radiation. Card 1/5

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On the Diffusion ...

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Typical microstructures of diffusion layers, formed during the diffusion of beryllium and aluminium into niobium at 1200 and 1300°C in a period of 6 hours are shown in Fig.1. Changes in the concentration of niobium along the depth of the diffusion layer in the system Nb-Be are shown in Fig.2. The main diffusion parameters were determined graphically and algebraically as well as by the method of least squares on the basis of metallographic analysis of the diffusion layer. The values of the diffusion coefficients are given in the table. The following temperature dependence of the diffusion coefficients was obtained:

$$D = 7.66 \times 10^{-4} \exp (-3200/RT) \text{ for NbBe}_{12}$$

$$D = 7.18 \times 10^{-8} \exp (-6700/RT) \text{ for NbAl}_3.$$

The large difference in the activation energies of diffusion of beryllium and aluminium is attributed to the difference in the diffusion mechanisms of beryllium and aluminium. The following niobium beryllides were established: NbBe₁₂, NbBe₈, NbBe₅ and NbBe₂. Furthermore, crystal structures of NbBe₁₂, NbBe₈ and NbBe₂ were established. NbBe₁₂ has space centred tetragonal

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On the Diffusion ...

lattice ($a = 7.376$, $c = 4.280$ kX), microhardness 1200 kg/mm^2 ; NbBe₈ - hexagonal lattice ($a = 7.56$, $c = 10.73$ kX); NbBe₂ - hexagonal lattice ($a = 4.516$, $c = 7.387$ kX). The crystal structure of NbBe₅ was not, as yet, determined. Aluminium also diffuses into niobium forming intermetallic phases. In the diffusion layer obtained at 1300°C during 6 hours, the following two phases were determined (the thickness of the second phase was very small): NbAl₃ with tetragonal lattice ($a = 3.846$, $c = 8.714$ kX) and NbAl₃ with cubic lattice ($a = 3.745$ kX). It can be assumed that the formation of phases in the systems Nb-Be and Nb-Al takes place by chemical combination. A similar character of the formation of phases was observed during the diffusion of silicon into niobium. The reaction of formation of phases takes place on the boundary: phase-diffusing element. A slower growth of subsequent phases is due to recrystallization of the structure and a lower velocity of diffusion. In many cases in the process of diffusion a solid solution is formed at first followed by a new subsequent phase. R.P.Petrova participated in the work. There are 2 figures and 1 table.

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On the Diffusion ...

Fig.1. Microstructure of niobium saturated with beryllium (Fig.1a) and aluminium (Fig.1b) in 6 hours at temperatures of 1200 and 1300°C respectively.



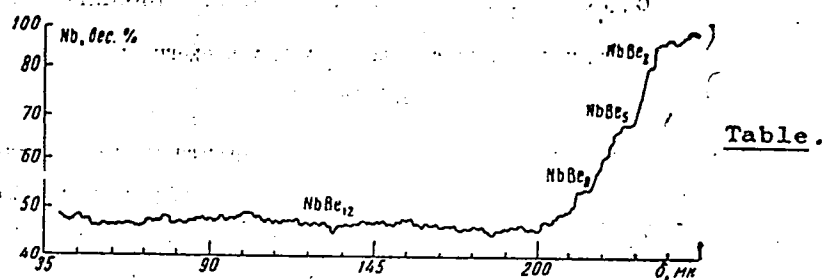
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On the Diffusion ...

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Fig.2. Changes in the concentration of Nb along the depth of the diffusion layer in the system Nb-Be.

Nb, wt % vs δ - distance from the surface, microns



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18 1200 2808, 1454 only

S/129/61/000/003/002/011
E073/E335

AUTHORS: Prokoshkin, D.A.: Doctor of Technical Sciences,
Professor and CHZhan Shao-Tszyun: Engineer

TITLE: Influence of Some Oxides on the Recrystallisation
of Molybdenum

PERIODICAL: Metallovedeniye i termicheskaya obrabotka
metallov, 1961, No. 3, pp. 9 - 11

TEXT: The authors studied the influence of oxides TiO_2 ,
 ZrO_2 and ThO_2 and complex admixtures containing Ti and ZrO_2
on the recrystallisation of molybdenum. The content of
 ZrO_2 and TiO_2 in the molybdenum did not exceed 0.5% and that
of ThO_2 did not exceed 2%. All the alloys were produced by
powder-metallurgy methods, using a 99.97% purity molybdenum
powder as a starting material. The ZrO_2 and ThO_2 particles
were introduced chemically by submerging the molybdenum
powder into an aqueous solution of zirconium nitrate and

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Influence of

thorium nitrate; during subsequent heating the oxides ZrO_2 and ThO_2 formed. Alloys with additions of TiO_2 were produced by mechanical mixing in an alcohol suspension of molybdenum powder with titanium-oxide powder. The Mo alloys with additions of ZrO_2 and ThO_2 were sintered by the passage of an electric current through the pressed mixture; the sintering temperature was about $2400^\circ C$. The alloys with TiO_2 were sintered at $1700^\circ C$ in a tubular furnace in wet hydrogen. The contents of the oxides in the molybdenum alloys are given in the table. After sintering, the specimens were forged at $1400 - 1300^\circ C$ into 2.5 mm diameter rods, which were drawn at $800 - 700^\circ C$ into 0.6 mm diameter wire, thereby achieving a reduction of 92%. For studying the recrystallisation, the specimens of all the alloys were held for 30 min in a salt bath at various temperatures between 900 and $1300^\circ C$. Microhardness, microstructure and X-ray investigations were carried out. The fact that recrystallisation

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Influence of

occurred was determined from a reduction in the microhardness or appearance of interference spots on the X-ray exposures obtained with chromium radiation. For measuring the microhardness and observing the structure, the specimens were polished using a solution containing 1 000 ml. water, 50 g potassium ferricyanide salt, 3 g caustic soda and 20 g Al_2O_3 powder. To remove the work-hardened layer polishing and etching were repeated several times. The optimum of three compositions was found to be the molybdenum alloy containing about 0.5% ZrO_2 . the decrease in the microhardness in this case begins at 1 200 °C. With decreasing quantities of the zirconium oxide the microhardness of the alloy decreases. An alloy with 0.1% TiO_2 was found to have the highest

recrystallisation temperature. On increasing the quantity of titanium oxide to 0.5% the microhardness dropped. Sodium oxide has a less pronounced effect on the recrystallisation temperature of molybdenum; the best was a molybdenum alloy containing 1% ThO_2 for which the recrystallisation threshold

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Influence of

was about 1 150 °C. A reduction in the content of the sodium oxide to 0.5% or an increase to 2% resulted in a decrease in the recrystallisation temperature. Of greatest interest is a molybdenum alloy - 0.5% Ti and 0.5% ZrO₂ this alloy con serves a high hardness up to ^{the} annealing temperature of 1 260 °C, which is higher by 350 °C than the recrystallisation temperature of pure molybdenum. It was found that alloys with the highest recrystallisation temperature had an almost equal total content by volume of oxides. This applies particularly to ZrO₂ and ThO₂. The following conclusions are arrived at:

- 1) introduction of oxides of titanium, zirconium and thorium into molybdenum impedes the process of recrystallisation and grain growth. For each system molybdenum-oxides a certain optimum oxide content exists which has the greatest effective influence on recrystallisation.
- 2) It was found that the admixtures 0.1% TiO₂, 0.5% ZrO₂

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Influence of

and 0.5% ZrO_2 + 0.5% Ti had the greatest influence. For the first two alloys the recrystallisation temperature was 300% higher and for the third alloy it was 350% higher than that for pure molybdenum. There are 6 figures, 1 table and 5 references: 3 Soviet and 2 non-Soviet.

ASSOCIATION: MVTU imeni Bauman

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Table:

Alloy No.	Oxide Content	Recrystallisation Threshold, °C	Alloy No.	Oxide Content	Recrystallisation Threshold, °C
1	0.176% ZrO ₂	1000	6	0.45% TiO ₂	1150
2	0.402% ZrO ₂	1150	7	0.57% ThO ₂	1100
3	0.483% ZrO ₂	1210	8	0.53% ThO ₂	1150
4	0.084% TiO ₂	1200	9	1.72% ThO ₂	920
5	0.217% TiO ₂	1190	10	0.706% ZrO ₂ + 0.475% Ti	1260

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4016, 2808, 2208, 1418, 1454

28870

S/130/61/000/001/009/000
E111/E380

AUTHORS: Zakharova, M.I. and Prokoshkin, D.A. (Moscow)

TITLE: Investigation of the niobium-molybdenum-chromium system

PERIODICAL: Akademiya nauk SSSR. Investiya. Otdeleniye tekhnicheskikh nauk. Metallurgiya i toplivo. no. 4, 1961, pp. 59 - 67 + 1 plate

TEXT: The Nb-Mo-Cr system is of great interest in view of the special properties of the metals and their alloys at ambient and high temperatures. An isothermal section was investigated using metallographic, X-ray diffraction and hardness measurements on specimens of alloys quenched from 1200 °C. Alloys were made from compact niobium (0.17% Ti, 0.12 Fe, 0.99 Ta), electrolytic chromium (0.00013% O, 0.0127 N, 0.0021 Pb, 0.0001 Sn, 0.0007 Sb, 0.0001 B) and sintered molybdenum rod (0.006% R₂O₃, 0.002 Ni, 0.01 SiO₂, 0.026 O) by arc-melting with a tungsten electrode on a water-cooled copper base, in argon purified by melting titanium.

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Investigation of

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The 20 - 30 g ingots were remelted 4 - 5 times with inversion. Chromium losses of 3 - 5% were allowed for in the charge. The alloys were annealed in argon at 1500 °C for 50 hours or for 100 if containing over 50% niobium. For etching agents were used for the microstructural investigation: 1) successive application of nitric and hydrofluoric acids (for niobium and high-Nb alloys); 2) one part sulphuric, one hydrofluoric, two nitric acid, one water (for alloys with up to 50 at.% Nb); 3) 10% oxalic acid for electrolytic etching at

0.3 - 0.5 A/cm² for alloys rich in molybdenum and chromium;

4) 30% aqueous hydrofluoric acid for electrolytic etching

at 0.1 - 0.2 A/cm² for alloys approximating the composition of NbCr₂. For X-ray investigations the alloys were powdered,

annealed in evacuated double quartz capsules at 1200 °C for 30 min and water-quenched; the asymmetric method with unfiltered chromium radiation was used. The alloy compositions formed three quasi-binary sections with molybdenum contents of

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E111/E380

Investigation of

10, 20 and 40 at.%. In addition, ternary alloys with 45, 60, 62 and 71 at.% Mo and binary alloys with 2 - 92.5 Nb (Nb-Cr), 10 - 40 Mo (Mo-Nb) and 10 - 50 Mo (Mo-Cr) were used. The Mo-Cr system is incomplete and discrepancies exist in the literature (e.g. in Ref. 5 - Bloom D.S., Puttman, I.W. and Grant, N.I. - Tans. AIME, 1954, 200, 261-268 - the thermal transformation at 12 at.% Mo). In the present work, only one phase could be found - a solid solution with a body-centred cubic lattice with a lattice parameter a increasing from 2.911 at 10.0 at.% Mo to 3.023 at 50.0; the corresponding hardness H_v values are 272 and 383 kg/mm². The Nb-Cr system

differs from the above, e.g. in the formation of a compound, NbCr₂ (Ref. 11 - P. Duwez and H. Martens - J. Metals, 1952, v.4., no. 1); at 1 200 °C the solubility of niobium in chromium is about 2 at.%, that of chromium in niobium being 11 at.%. Changes in the lattice-parameter values of NbCr₂

and the microstructure of the alloys show that a homogeneous region, based on NbCr₂, exists in the Nb-Cr binary system.

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In the Nb-Mo-Cr ternary system, a solid solution alpha (beta) is formed at each corner, with the widest extent at the molybdenum corner. For finding precisely the phase boundaries in the ternary alloys those of the 10 at.% Mo section were investigated. These alloys were made from powders of niobium (98.7%, with 0.03 Fe, 0.03 Ti, 0.20 Pb, 0.04 Si and 18 [Abstractor's note - 1.8% Co), molybdenum (99.65%, 0.01 R_2O_3 , 0.001 Ni, 0.24 O_2) and electrolytic chromium. The powders were sintered in vacuum for 10 hours at 1 500 °C before fusion. Hardness and lattice parameter measurements were also carried out on the ternary alloys. The 1 200 °C isothermal section of the ternary system is shown in Fig. 7. Points of type 1 - 6 indicate data obtained by microstructural analysis; type 7 points indicate phase boundaries from X-ray structural data.

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There are 7 figures, 4 tables and 15 references: 8 Soviet-bloc and 7 non-Soviet bloc. The four latest English-language references quoted are: Ref. 3 - H.D. Kessler and M.A. Hansen - Trans.AIME, 1950, 42, 1008; Ref. 4 - I.W.Putnam, R.D. Potter and N.I. Grant - Trans. AIME, 1951, 43, 824-847; Refs. 5 and 11 (quoted in text).

SUBMITTED: November 23, 1960

Card 5/6

PROKOSHKIN, D.A.; IVANOV, L.I.; YANUSHKEVICH, V.A.

Activation energy of the steady creep of -titanium. Izv.vys.
ucheb.zav.; fiz. no.5:65-67 '61. (MIRA 14:10)

1. Institut metallurgii imeni A.A.Baykova.
(Creep of materials) (Titanium)

34535

S/659/61/007/000/022/044

D204/D303

18.11.35

AUTHORS: Prokoshkin, D.A., Datveyeva, M.P., and Morozov, V.A.

TITLE: Study of the resistance of Cr-Mo alloys to plastic deformation, based on measuring hot hardness

SOURCE: Akademiya nauk SSSR. Institut metallurgii. Issledovaniya po zharoprochnym splavam, v. 7, 1961, 210-213

TEXT: Alloys containing 0 - 40 % Mo were prepared from electrolytic 99.96 % Cr, containing 0.014 % N₂ and 0.01 % O₂, and electrolytic 99.85 % Mo by fusion under He, and were cast into cylindrical ingots which were then annealed for 4 hours at 1400°C. The hardness was measured on 14.8 mm dia. x 5 mm long specimens, on polished ends, using a БММ-1 (VIM-1) tester. A diamond indenter was used, in the shape of a tetragonal pyramid with an apical angle of 136°, under a load of 1 kg, between 400 and 1080°C. Duration of each test was 30 secs. and the diagonals of the impressions were then measured with an МММ-6 (MIM-6) microscope with an accuracy of ± 0.002mm. It was found that, in all cases, the hardness decreased with rising temperature. X
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Study of the resistance of Cr-Mo ...

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D204/D303

temperature up to 600°C, passed through a maximum at 750°C and then decreased again at higher temperatures. It was also higher for higher Mo contents. In a second series of tests the hot hardness was measured under a load of 1 kg, at 1080°C, over periods of 30, 60, 120, 300 and 1200 secs. The rates of plastic deformation, calculated from these results, confirmed the observation that Mo improved the resistance to plastic deformation. There are 3 figures, 1 table and 2 Soviet-bloc references.

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34536

S/659/61/007/000/023/044
D217/D303

18.11.00

AUTHORS: Arzhanyy, P.M., Volkova, R.M., and Prokoshkin, D.A.
TITLE: Kinetics of oxidation of niobium and its alloys
SOURCE: Akademiya nauk SSSR. Institut metallurgii. Issledovaniya po zharoprochnym splavam, v. 7, 1961, 214 - 220

TEXT: This work is concerned with the oxidation of niobium after alloying its surface with various elements. Niobium of the following chemical composition was used as the material for study: 98.9 % Nb, 0.4 % Ta, 0.15 % Pb, 0.13 % Fe, 0.08 % N, 0.09 % O, 0.01 % Si, 0.14 % C and 5×10^{-5} % B. The hardness of the material was 200 kg/mm². The material was made into specimens which were subjected to cementation with Si and Ti. The diffusion layer was analyzed metallographically and by X-ray spectral methods, as well as by microhardness measurements. The distribution of the diffusion components through the depth of the protective layer was measured by means of the instrument PCAW -2 (RSASh-2) by A.N. Deyev. The specimens were tested for oxidation by continuous weighing with an accuracy of

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X

Kinetics of oxidation of niobium ...

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± 0.0005 g. The oxidized layer was studied metallographically and by means of X-ray and electronographic methods. During saturation of Nb with Ti and Si, diffusion layers of complex structure and composition form. At 900 ~ 1100°C, a single layer having a microhardness of approximately 1200 kg/mm² forms, and at 1200 and 1300°C two layers form, the thickness of the second layer being 5 - 6 μ. The microstructure and microhardness measurements show that the same phase forms on the surface of saturated specimens at all temperatures and times of soaking. By means of X-ray spectral and X-ray structural analysis, it was found that this phase consists of niobium disilicide in which Ti is dissolved; this has a hexagonal lattice with parameters a = 4.779 KX and c = 6.493 KX. The Nb content of the second layer is approximately 82 %. The phases Nb₅Si₃ and Ti₅Si₃ have identical crystal lattices. Ti and Nb form a continuous series of solid solutions, and it can, therefore, be assumed that the second phase consists of a solid solution of Ti₅Si₃ and Nb₅Si₃. The thickness of the diffusion layers forming on the surface

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Kinetics of oxidation of niobium ...

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ce of Nb depends on temperature and time for formation. Niobium surfaces protected by Si and Ti oxidize nearly one and a half times more slowly at 1200°C than ones protected only by Si. The scale formed is thin, strong and well adherent. There are 1 figure, 6 tables and 6 Soviet-bloc references.

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X

34550

S/659/61/007/000/039/044
D205/D303

18.11.50

AUTHORS: Korneristyy, Yu.K., Bannykh, O.A., Zudin, I.F., and
Prokoshkin, D.A.

TITLE: Influence of aluminum and carbon on properties of
steel with 10 % Cr and 13 % Mn, at elevated tempera-
tures

SOURCE: Akademiya nauk SSSR. Institut metallurgii. Issledo-
vaniya po zharoprochnym splavam, v. 7, 1961, 317-328

TEXT: The influence of Al addition in the range of 2.35 - 4.67 %
and of C in the range of 0.1 - 0.8 % was investigated in 10 % Cr
and 13 % Mn steel in which the appearance of the σ -phase is exclu-
ded. The samples were prepared by smelting in a magnesite crucible,
in an induction furnace, and consisted of Armco iron, Cr, Mn (96.5%
pure) and Al metal. C was introduced by addition of synthetic cast
iron. The ingots were forged into cylinders of 12 and 20 mm diame-
ter, starting the forging at 1150° - 1200°C ending at 750°C. The
samples were then hardened by quenching in water from 950°C for 2
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Influence of aluminum and carbon ...

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hours prior to testing. The resulting structures were: Without Al and with 0.1 % (I), with 2.5 % Al, 0.4 % C (V) and with 2.5 % Al, 0.8 % C (VI). These steels were austenitic. With 2.35 % Al and 0.1 % C (II) the structure was 65 % austenite 35 % ferrite; with 3.12 % Al, 0.1 % C (III) - 90 % ferrite; with 4.67 % Al, 0.1 % C (IV) - 100 % ferrite. The temperature dependence of strength and plasticity was examined, using an ИМ-4Р (IM-4R) machine. The hot hardness was examined at 700°, 800° and for samples V and VI also at 900°C, on the ВМ-ИМ (VIM-IM) apparatus, using a sapphire indentor. Resistance to creep was examined on the ИП-2 (IP-2) and IP-5 machines, using stresses of 9 kg/mm² in the temperature range of 550 - 750°C. Resistance to scaling was examined by the weight gain of samples heated for various times in muffle furnaces in the 900 - 1200°C temperature range. The austenite of the 10 % Cr, 13 % Mn and 0.1 % C steel is unstable and is transformed into martensite under the action of plastic deformation. Aluminum exerts a high ferrite-forming action and lowers the high-resistance characteristics. Exploiting the γ -forming ability of carbon, the austenitic structure can be achieved in steel containing aluminum. 0.4 % of C in the presence

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Influence of aluminum and carbon ...

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of 2.5 % Al gives a stable austenitic structure. The resistance of this steel (V) is higher than that of the other investigated steels. The resistance to scaling increases sharply with an increase of Al content. The increase of C up to 0.4 % lowers the resistance to scaling. Further increase of C to 0.8 % has little bearing in this respect. Steel (V) has good heat and scale resistances up to 700°C and can be used for durable service under stress up to 650°C, instead of Cr-Ni steel 1X18H9T (1Kh18N9T). There are 7 figures, 1 table and 12 references: 10 Soviet-bloc and 2 non-Soviet-bloc. The references to the English-language publications read as follows: Brady and Baughner, Iron Age, 194, no. 7, 1959. A.J. Schmatz, Metal Progr. 76, no. 4, 1959.

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ACCESSION NR: AT4009495

S/2509/63/000/014/0068/0077

AUTHOR: Banny*kh, O. A.; Zudin, I. F.; Kashin, V. L.; Prokoshkin, D. A.;
Samarin, A. M.

TITLE: Properties of ferrite aluminum-iron alloys

SOURCE: AN SSSR. Institut metallurgii. Trudy*, no. 14, 1963. Metallurgiya,
metallovedeniye, fiziko-khimicheskiye metody* issledovaniya, 68-77

TOPIC TAGS: aluminum alloy, iron alloy, aluminum-iron alloy, ferrite alloy, melting,
forging, heat treatment

ABSTRACT: Some properties of aluminum-iron alloys are of industrial importance, but they are not commonly used as construction materials. In the present work a number of these alloys were exposed to melting, forging and heat treatment, after which they were studied for specific gravity, impact strength, rupture strength and plasticity under various conditions. The chemical composition of the alloys used in the investigation is given in Table 1 of the Enclosure. Two series of alloys were melted: one group in air and the other in a vacuum. It was found that vacuum melting of the alloy improves the mechanical properties, especially under high-temperature conditions. Figure 1 of the

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ACCESSION NR: AT4009495

Enclosure shows the dependence of the rupture strength and plasticity of the alloy on the aluminum content. The curves show that an increase in the aluminum content to about 15% increases the strength of the alloy between 20-600C; at 700C the strength does not depend on the aluminum content. The alloy has a maximum strength and satisfactory plasticity at 400C; the strength drops sharply and the plasticity simultaneously increases at temperatures over 600 C. Aluminum-iron alloys may thus be used under stress without adding a third element at temperatures below 600C. Figure 2 of the Enclosure shows that an increase in the aluminum content in the alloy increases grain size at 1,100C. Additional studies on the effect of admixtures (Ti, Zr, B, Ni, W) on the properties of the Al-Fe alloys shows that the introduction of titanium, zirconium, and boron into alloys with 10% Al does not change the strength of the alloy. Zirconium and boron lower the scaling resistance of the alloy while additions of nickel and tungsten to an alloy with 15% Al lowers the strength and plasticity of the alloy. Orig. art. has: 7 figures and 6 tables.

ASSOCIATION: Institut metallurgii, AN SSSR. (Metallurgical Institute, AN SSSR)

SUBMITTED: 00

DATE ACQ: 25Jan64

ENCL: 04

SUB CODE: MM

NO REF SOV: 008

OTHER: 011

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ACCESSION NR: AT4009495

ENCLOSURE: 01

Alloy No.	Content %				
	Al	Mn	Si	O	N
Air-melted alloys					
1	4,87	0,023	0,032	0,0150	0,0048
2	9,80	0,094	0,065	0,0052	0,0090
7	8,70	0,010	0,047	0,0051	0,0040
8	12,70	0,005	0,048	0,0097	0,0090
9	15,00	0,018	0,013	0,0033	0,0090
Vacuum-melted alloys					
3	10,38	<0,010	0,030	0,0031	0,0110
4	12,19	<0,010	0,030	0,0048	0,0070
5	14,92	<0,010	0,030	0,0028	0,0070
6	16,82	<0,010	0,030	0,0020	0,0040

TABLE 1 - Chemical composition of the alloys tested.

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ENCLOSURE: 02

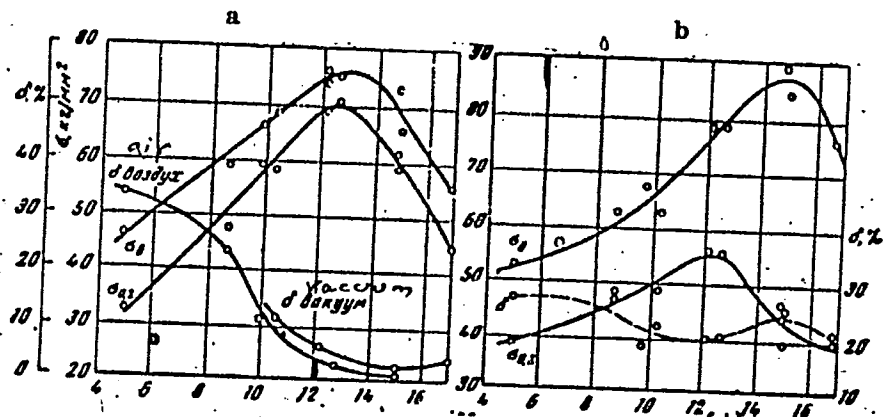


Fig. 1 - Dependence of rupture strength and plasticity of alloys on aluminum content
a - at 20C; b - at 400C; c - at 500C; d - at 600 and 700C

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Fig. 1 (Continued)

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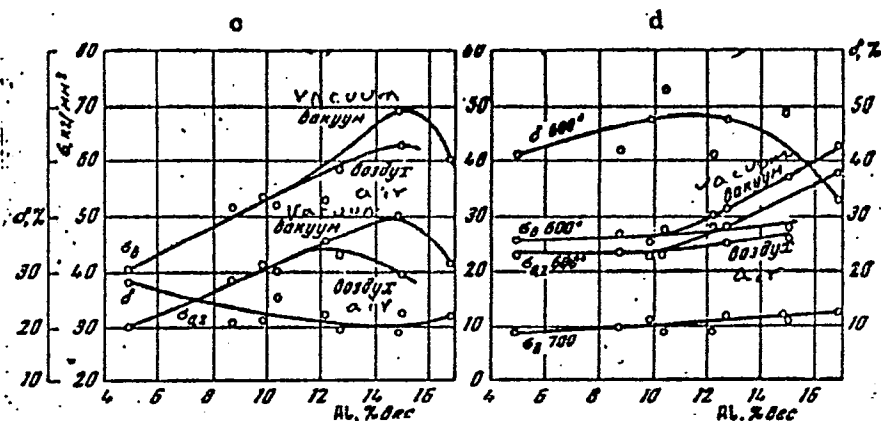


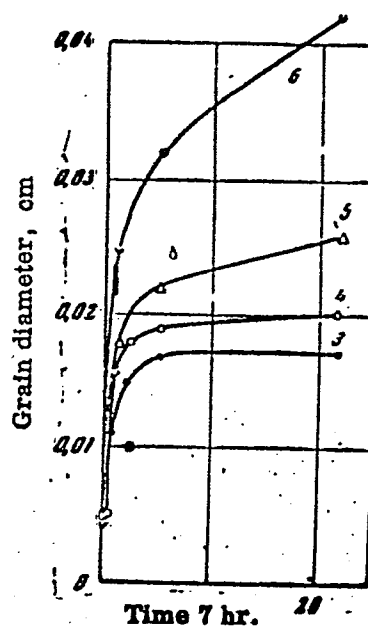
Fig. 1 - Dependence of rupture strength and plasticity of alloys on aluminum content
a - at 20C; b - at 400C; c - at 500C; d - at 600 and 700C

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ENCLOSURE: 04

Fig. 2 - The dependence of the average grain size on the duration of treatment at 1,100C for vacuum-melted alloys 3-6 - alloy nos. (see Table 1 of the Enclosure)



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ACCESSION NR: AT4013955

S/2659/63/010/000/0219/0225

AUTHOR: Prokoshkin, D. A.; Vasil'yeva, Ye. V.; Popov, N. N.

TITLE: The properties of alloys of the niobium-tungsten-titanium system

SOURCE: AN SSSR. Institut metallurgii. Issledovaniya po zharoprochny'm splavam, v. 10, 1963, 219-225

TOPIC TAGS: alloy strength, alloy property, alloy oxidation, niobium alloy, niobium tungsten titanium alloy, tungsten containing alloy, titanium containing alloy, ternary alloy

ABSTRACT: In view of the fact that binary alloys containing Nb can be used only for special purposes, the authors undertook a study of the structure and properties of five ternary alloys of the Nb-W-Ti system containing 15% by weight of W and 0, 3, 10, 15 or 20% by weight of Ti. The alloys were prepared from 99.9% pure niobium, 99.95% pure tungsten, and iodide titanium in an arc furnace (purified argon atmosphere) with a nonconsumable electrode on a watercooled Cu bottom. Two test ingots were prepared from each alloy and subjected to diffusion annealing for 48 hours at 1700C. The authors studied the microstructure of the cast and annealed samples, the specific gravity, the hardness at room and high temperatures, high-temperature creep and the oxidation behavior. As expected, the specific gravity decreased with increasing Ti content, as did the hardness at

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room temperature. Annealing produced a decrease in hardness, homogenized the microstructure and eliminated the dendritic structure. The high-temperature hardness (600-1000C) increased with increasing Ti content, reached a maximum at 10% Ti and then decreased sharply. Creep strength was only insignificantly affected by Ti content (increasing slightly with % Ti), while the rate of oxidation tended to decrease with increasing Ti content, reaching a minimum at 10% Ti. The mechanism of oxidation of Nb-W-Ti alloys is discussed. Orig. art. has: 3 tables and 3 figures.

ASSOCIATION: Institut metallurgii AN SSSR (Institute of Metallurgy AN SSSR)

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ENCL: 00

SUB CODE: MM

NO REF SOV: 006

OTHER: 006

Card 2/2

ACCESSION NR: AT4013956

S/2659/63/010/000/0225/0228

AUTHOR: Prokoshkin, D. A.; Arzamasov, B. N.

TITLE: Investigation of chromium-tungsten alloys by the thermal diffusion method

SOURCE: AN SSSR. Institut metallurgii. Issledovaniya po zharoprochny'm splavam, v. 10, 1963, 225-228.

TOPIC TAGS: chromium, tungsten, chromium tungsten alloy, constitutional diagram, thermal-diffusion process

ABSTRACT: There are differences of opinion about many high-temperature metal systems. In particular, there are contradictory data on chromium-tungsten alloys. The authors together with V. A. Brostrem, who participated in the experimental part of the work, used the thermal diffusion method for specifying the constitutional diagram of this alloy. The diagram allows one to determine the different phases of the system during diffusive saturation under isothermic conditions. The author shows that W. Trzebiatowski, M. Ploszek,

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and J. Lobzowski (X-ray analysis of chromium-molybdenum and chromium-tungsten alloys. Anal. Chem., 19, 2, 1941) did not determine one of the phases of chromium-plated tungsten, as the X-ray analysis was performed on deformed powders of the Cr-W alloy. On the basis of tests with the Cr-W alloy it was possible to assume that annealing of Cr-W alloy powders prior to X-ray analysis allows one to detect the CrW₃ phase, which the authors found by using the thermal diffusion method. Orig. art. has: 4 figures.

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DATE ACQ: 27Feb64

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OTHER: 001

Card 2/2

ACCESSION NR: AT4013922

S/2659/63/010/000/0022/0027

AUTHOR: Prokoshkin, D. A.; Matveyeva, M. P.; Morozov, V. A.

TITLE: An investigation of the process of plastic deformation of chromium at high temperatures

SOURCE: AN SSSR. Institut metallurgii. Issledovaniya po zharoprochny*
splavam, v. 10, 1963, 22-27

TOPIC TAGS: chromium, chromium alloy, chromium deformation, chromium stress, plastic deformation, creep, high temperature creep, molybdenum

ABSTRACT: The basic task of the investigation was a study of the influence of the substructure formed in the process of creep at high temperatures on the subsequent resistance of chromium and chromium alloys to plastic deformation. The tests were performed with pure electrolytic chromium (99.96%). Chromium samples 55 mm long and 6 mm in diameter were cast in pure helium and were then tested for creep on the IM-4K machine under constant torque at temperatures up to 1500-1600C. It was found that one of the most important factors at high temperatures is the position of the boundaries and the presence of processes

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arising at the boundaries. Photomicrographs in the article show the gradual development of defects at the grain boundaries in the process of buckling of the chromium sample at 1200C and a load of 2.05 kg/mm². Another part of the experiment involved tests on molybdenum. It was found that molybdenum failure at the grain boundaries started at a significantly lower degree of deformation, which showed that molybdenum has a higher resistance to plastic deformation and a relatively lower plasticity in comparison to chromium. Thus, when creating heat-resistant alloys, not only should the solid solution be strengthened, but the possibility of strengthening the grain boundaries should be considered. Orig. art. has: 3 figures.

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NO REF SOV: 002

OTHER: 001

Card 2/2

ACCESSION NR: AT4013926

8/2659/63/010/000/0044/0046

AUTHOR: By*strov, L.N.; Ivanov, L.I.; Prokoshkin, D.A.

TITLE: A study of nickel diffusion in nickel-copper alloys

SOURCE: AN SSSR. Institut metallurgii. Issledovaniya po zharoprochny'm splavam, v. 10, 1963, 44-46

TOPIC TAGS: nickel, nickel-copper alloy, diffusion coefficient, electrolytic nickel, nickel diffusion

ABSTRACT: A study has been made of the diffusion coefficient in pure electrolytic nickel and nickel-copper alloys. In laboratory scale experiments, three test specimens of alloys with 0.05, 1 and 10% copper, and one specimen of pure electrolytic nickel were used as strips 70 mm long, 8 mm wide and approximately 50 μ thick with solid copper plates, soldered at each end, serving as contacts. The radioactive isotope Ni^{63} was deposited in the middle section of the specimen by atomization in vacuum on one side only. The strips were heated many times to 1100-1300C by passing alternating current through pure helium. After every heating, radioactivity measurements were taken from each side of the strip. The results of the study showed that the diffusion coefficient was higher

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for pure nickel and lower for its alloys (Ni-Cu). The energy of diffusion of Ni initially increases by a factor of 10-15 K. Cal./Mole when copper is added as shown in Fig. 1 of the Enclosure. Thus, this study confirmed the results of similar studies on Ni-Cu alloys by Kryukov and Zhukhovitskiy (Dokl. AN SSSR 90, no. 3, 1963), and by Reynolds et al. (Acta Met. 5 no. 1, 29, 1957). These studies were conducted with nickel-gold alloys, as the nearest system to Ni-Cu alloys. Orig. art. has: 2 figures, 1 formula and 1 table.

ASSOCIATION: Institut metallurgii AN SSSR (Metallurgical Institute AN SSSR)

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DATE ACQ: 27Feb64

ENCL: 01

SUB CODE: MM

NO REF SOV: 002

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ACCESSION NR: AT4013926

ENCLOSURE: 01

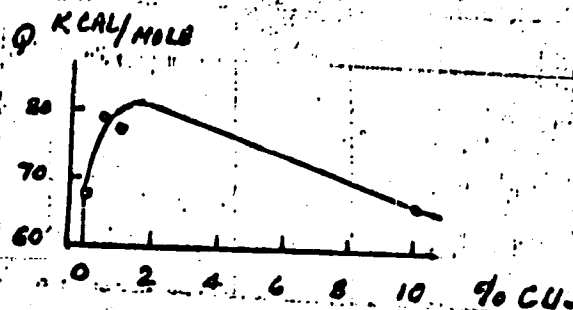


Fig. 1 Energy of activation of diffusion of nickel in nickel-copper alloys vs. copper content.

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AUTHORS:

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S/659/61/007/000/04⁴
D231/D303
Prokoshkin, D.A., Bannykh, O.A., Bratenko, V.N., and
Zudin, I.F.

TITLE:

Investigating some heat-resistant chromium-manganese
steels alloyed with nitrogen, molybdenum and boron

SOURCE:

Akademiya nauk SSSR. Institut metallurgii. Issledova-
niya po zharoprochnym splavam, v. 7, 1961, 370 - 378

TEXT: The authors investigated heat-resistant Cr-Mn steels contain-
ing 17 % Cr, 13 % Mn and 0.2 % N. According to the equilibrium
diagram for the Fe-Cr-Mn system an alloy containing 17 % Cr and 12%
Mn at temperatures above 850 - 870° possesses an austenitic-ferrite
structure and at very low temperatures the ferrite decomposes form-
ing the σ -phase. Addition of 0.2 % N ensures the stable structure
of the γ -solid solution near to the saturation limit. Mo increases
the heat-resistance of steel by entering both into the α -solid so-
lution and into the γ -solid solution. Alloying the above steel with
Mo enabled the dependence of the heat-resistant properties on the
phase composition of the steel and the degree of saturation of γ -
and 1/3

Investigating some heat-resistant ...

S/659/61/007/000/044/044
D231/D303

and α -solid solution to be investigated. The investigation consisting of two parts was carried out with the following steels: 1) 0 % Mo; 2) 1 % Mo; 3) 3 % Mo; 4) 5 % Mo (part I); 5) 3 % Mo + 0.001 % B; 6) 3 % Mo + 0.004 % B; 7) 3 % Mo + 0.008 % B (part II). Part I: Tests carried out were: 1) Dependence of the hardness of various steels on the quenching temperature; 2) Microstructure after quenching from 1000°C; 3) Dependence of the ultimate strength and corresponding elongation on temperature in the range 600 - 900°C; 4) Measurement of creep resistance at 700°C and 750°C; 5) A steel quenched (from 1100°C) in water, then subjected to ageing (at 750°C) for 10 hours was investigated for strength and ductility when tested to fracture (20 - 900°C) also for temperature dependence of the impact strength, long-time thermal stability and long-time strength under a load. The results are fully discussed. Part II: According to S.M. Vinarov (Ref. 10: Trudy MAI, no. 123, Oborongiz, 1960) the ability of small amounts of B to increase the heat resistance of steels depends on the method of introducing B into the steel and the chemical composition of the latter. The steels chosen were those previously investigated in part I which showed small creep resistance. All the investigated steels after quenching (from 1150°C) X
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